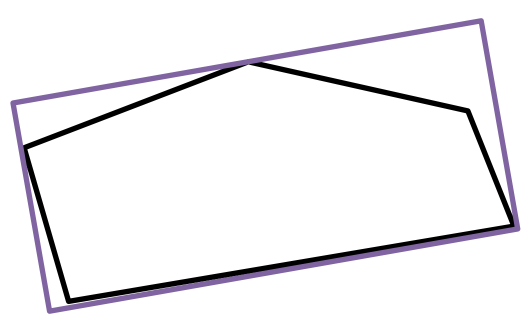
CS133 Assignment 4

Due date: Thursday 5/23/2019, 11:59 PM

1. (3 points) In the class, we studied the closest pair problem using the Euclidean distance. Explain how the same divide-and-conquer algorithm can apply using the Manhattan distance. In particular, show how many points need to be compared along the split line. Manhattan distance between two points $p_1 = (p_1.x, p_1.y)$ and $p_2 = (p_2.x, p_2.y)$ is defined as below
$$M(p_1, p_2) = |p_1.x - p_2.x| + |p_1.y - p_2.y|$$
This resembles the distance in the grid-like road network of Manhattan.

2. (5 points) Describe a linear time algorithm to find the oriented minimum bounding rectangle (MBR) of a convex polygon P. The MBR is the smallest-area rectangle that encloses the given polygon. Unlike the orthogonal MBR which can only have orthogonal edges, the oriented MBR can take any orientation similar to the figure below.
Explain your algorithm and provide a pseudo code. Analyze the running time of your algorithm.



Hint 1: The oriented MBR of a polygon has to be aligned to one of its edges.
Hint 2: You can use a variation of the rotating calipers technique to answer this problem.

3. (2 points) In the class, we proved that any polygon without a hole in it can be triangulated. Does this also apply to polygons with holes? Explain why or why not.